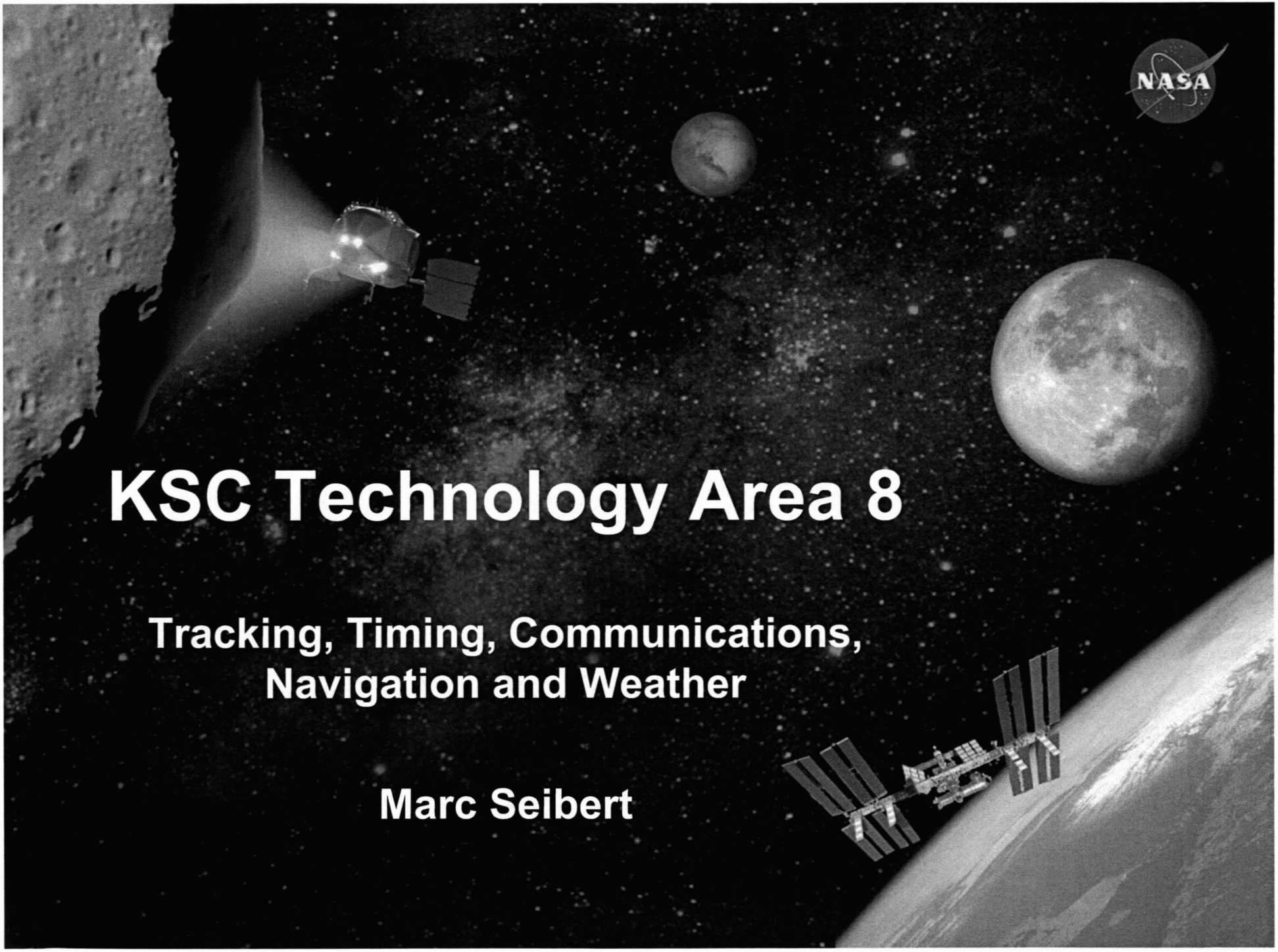


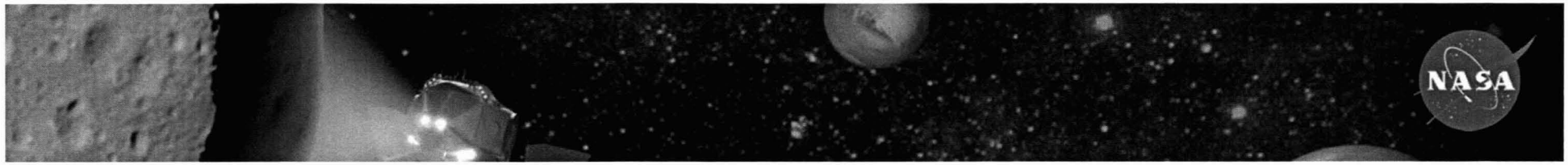
KSC Technology Area 8

Tracking, Timing, Communications, Navigation and Weather

Marc Seibert

Introduction

- Tracking, Timing, Communications and Navigation are critical to all NASA missions
- Accurate weather prediction is critical to KSC launch activities
- KSC is involved with and in several cases leading research and development in many exciting areas and with partners
- We welcome new partners in all of these areas!



Optical/Laser Comm

Existing partnership

Wave Propagation Research Group

Description:

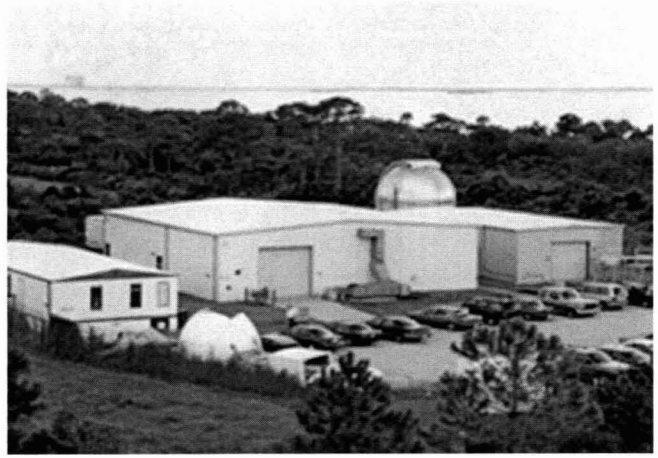
The Wave Propagation Research Group, WPRG, is an informal consortium of KSC engineers, UCF faculty and graduate students and industry engineers who meet weekly to discuss and study atmospheric propagation, laser Free Space Optical (FSO) communications and laser radar applications. The group has been in existence for over 8 years.

The WPRG regularly publishes in scientific journals, submits proposals, and receives funding, primarily from DoD/DARPA, for laser propagation research and FSO communication.

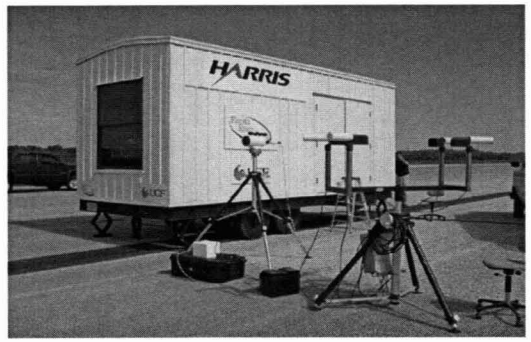
KSC role: Collaborates with NASA Engineering, and other directorates. Performs testing at ISTEF laser facility and optical ranges including the Shuttle Landing Facility

Team

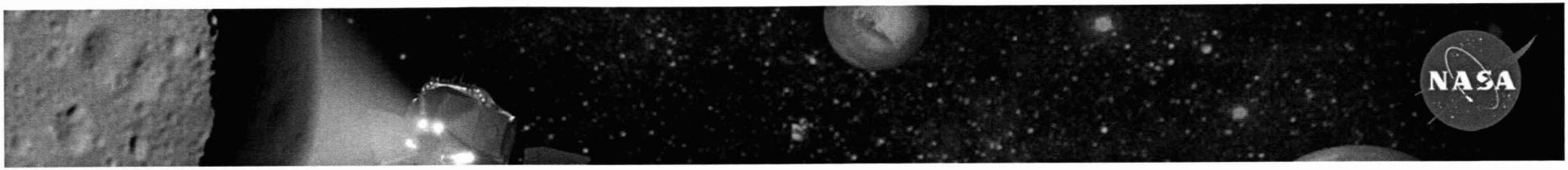
- UCF: Emeritus Professors Dr. Ron Phillips and Dr. Larry Andrews, Robert Crabbs
- Govt. Partners: NASA KSC, UCF, U.S. Navy (SPAWAR)
- Industry Partners: Computer Sciences Corporation, Harris, Northrop Grumman, NASA engineering support contractors



The ISTEF Site is located at the Kennedy Space Center, Florida. It is a Navy SSC PAC facility operated by CSC.



Instrumentation van (left), scintillometer receiver (middle) and visibility meter (right) taking measurements at the Shuttle Landing Facility.



Robotic Precursor Activities

Uplink radar activities

Four Meter Goldstone Imaging of Near Earth Objects

Description:

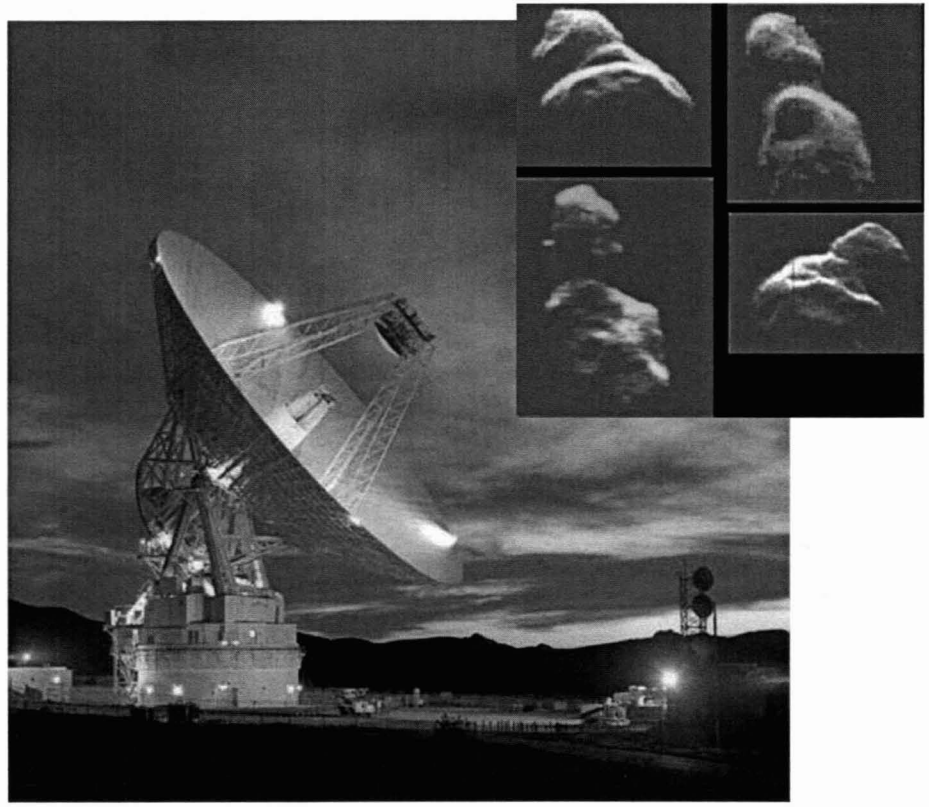
Develop innovative approaches to characterize potential destinations for human exploration. Utilize high-resolution Goldstone Solar System Radar (GSSR) imaging of near-Earth objects (NEOs). KSC participation includes analysis activities, and exposure to uplink radar methodologies to prepare for future KSC projects.

Relevance to Human Spaceflight:

The US Space Policy directs NASA to send a human to an Asteroid to conduct scientific investigations by 2025. Characteristics of most of the 600,000 NEO's/NEA's are minimally understood. Human missions will most likely be preceded by robotic missions. Identifying the most promising NEO's/NEA's to explore requires Earth-based radar investigation and down-selection prior to mission definition.

Current partnership

- Lead Center: JPL
- Project Lead: Lance Benner
- KSC POC: Marc Seibert/Tom Ford
- Supporting Centers: JPL, JSC, GSFC, KSC



Ka-Band Uplink Array Projects

Description:

Uplink array radar is performed today at X and C bands. It is useful for a variety of applications, including imaging of orbital debris, and Near-Earth Asteroids. KSC is standing-up an Uplink Array Testbed this year, with the goal of performing Ka-band uplink arraying with a larger array down the road.

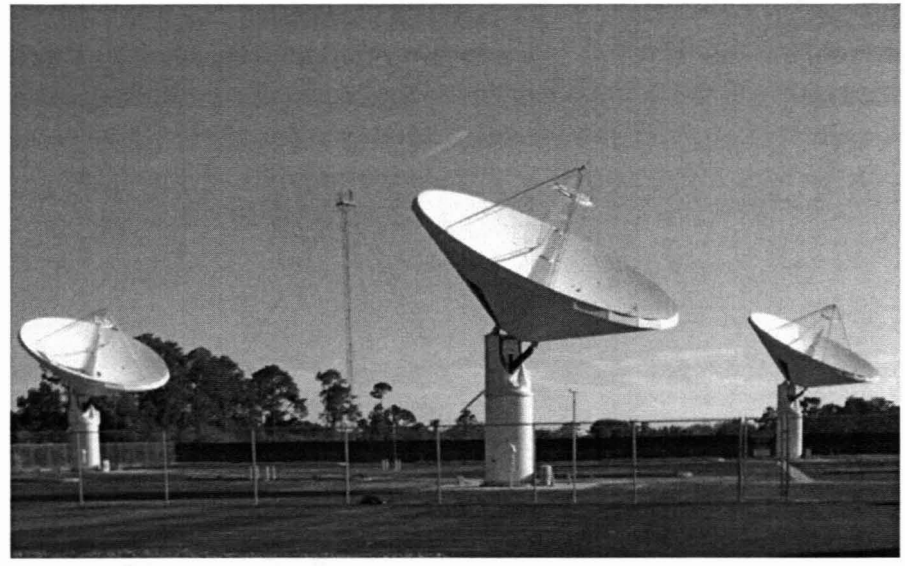
The project is funded by multiple government Agencies, and partners are welcome to help solve the many technical challenges of imaging at Ka-band.

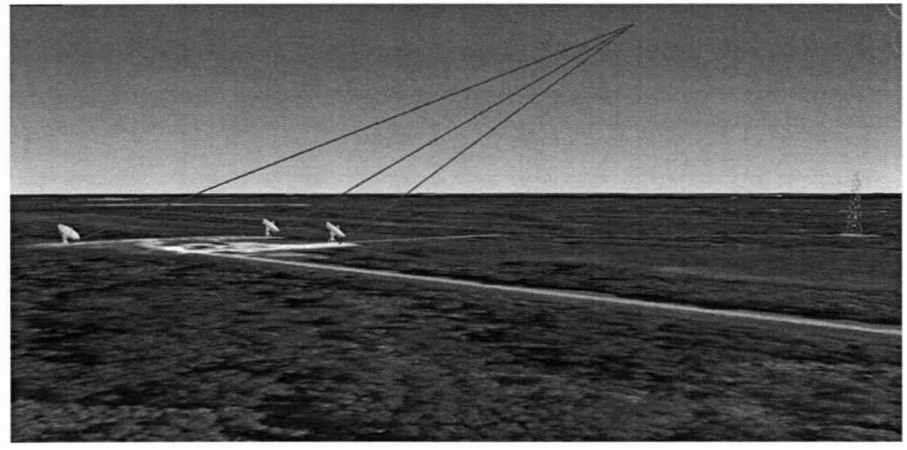
Relevance to Human Spaceflight:

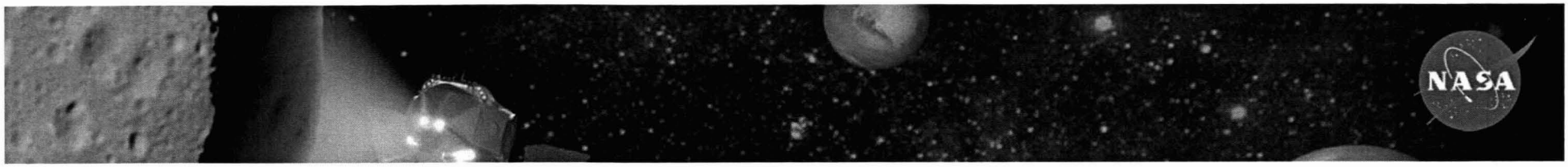
Improved means to image orbital debris are needed. Characteristics of most of the 600,000 NEO's/NEA's are minimally understood. Human missions will most likely be preceded by robotic missions. Identifying the most promising NEO's/NEA's to explore requires Earth-based radar investigation and down-selection prior to mission definition.

Team

- Lead Center: KSC
- Project Leads: Marc Seibert/Mike Miller
- Partners: Several other gov't Agencies and commercial partners







NASA Analog Missions

The "proving grounds" for low to mid TRL capabilities for future human spaceflight

Analog Missions: Space Communications and Navigation

Description:

KSC personnel are responsible for designing, developing, deploying, and operating a communications, networking, timing and navigation infrastructure for NASA/HEO Analog missions that resembles concept future Human Spaceflight mission architectures.

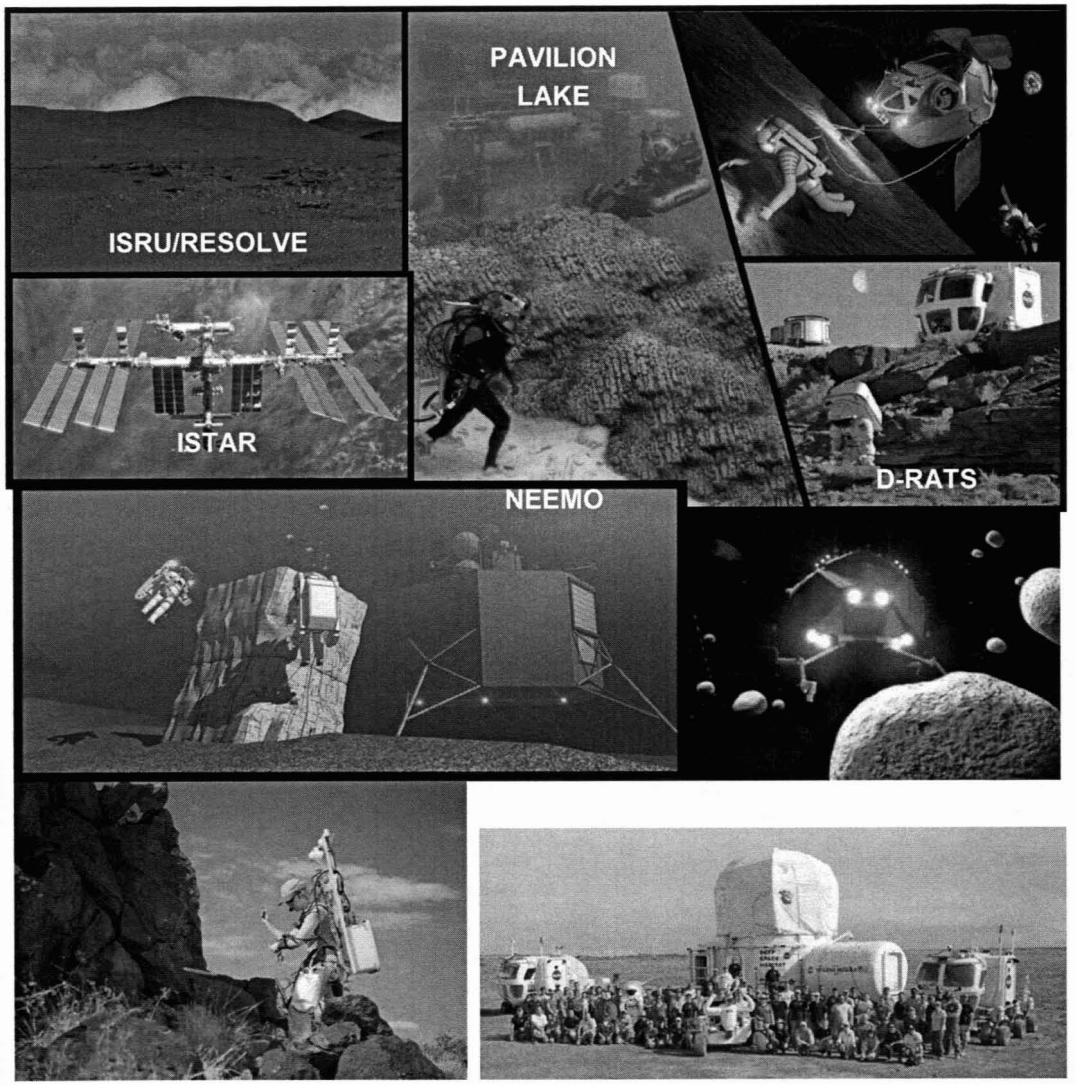
KSC personnel maintain a "common analogs communication capability" for all AES analogs and year-round home center testing.

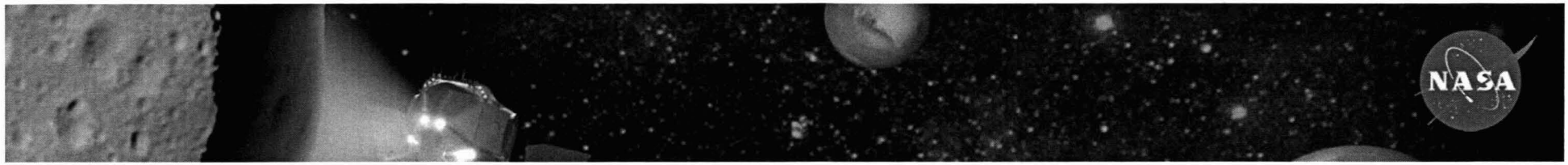
Relevance to HSF:

Analogs provide the venue for HEO to validate a variety of future architecture concepts, systems and technologies with partners and produce measurable results. The results of these missions directly influence Agency architecture planning.

Team

- Lead Center: JSC
- Project Lead: Barbara Janoiko
- KSC POC (Comm): Marc Seibert
- Supporting Centers: KSC, ARC, GSFC





Crew Mobility Systems

Developing the comm and nav for next-generation spacecraft

Multi-Mission Space Exploration Vehicle (MMSEV) Cabin: PCT and Communication Avionics

Description:

KSC personnel are designing, developing, prototyping, and testing sequential generations of critical communication and networking avionics for the Multi-Mission Space Exploration Vehicle (MMSEV).
The team validates future avionics concepts in relevant terrestrial environments in preparation for flight test demos. The goal is to advance the capabilities of future avionics, and enable avionics commonality across other spacecraft (SLS, Deep Space Habitat, MPCV, etc)

Relevance to HSF:

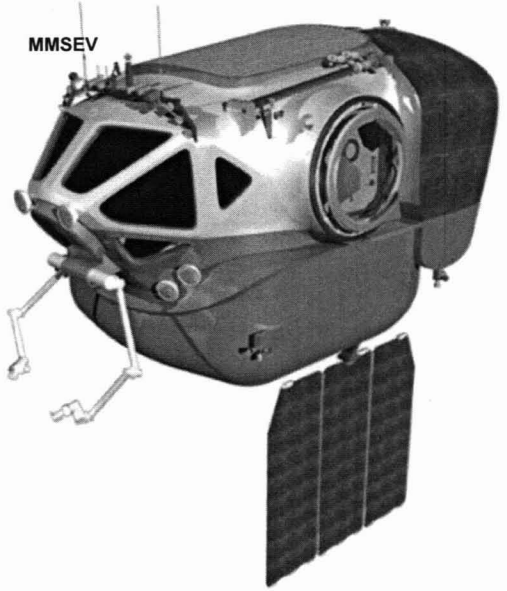
The MMSEV plays a prominent role in design reference missions (DRM) for crew exploration at a near earth asteroid (NEA) and on surfaces. Lean development approaches and common components will be utilized to perform early spacecraft design and development at a low cost.

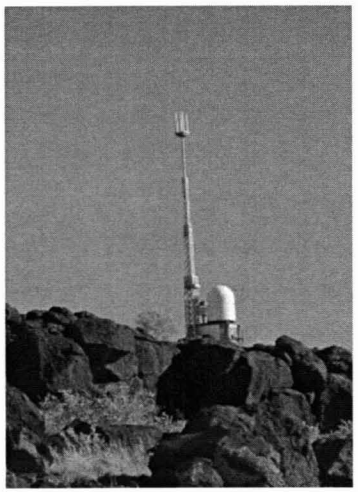
Team

- Lead Center: JSC
- Project Lead: Mike Gernhardt
- KSC POCs: Marc Seibert/Mike Miller
- Supporting Centers: JPL, LaRC, KSC
- Partnerships: General Motors, Caterpillar, et. Al.

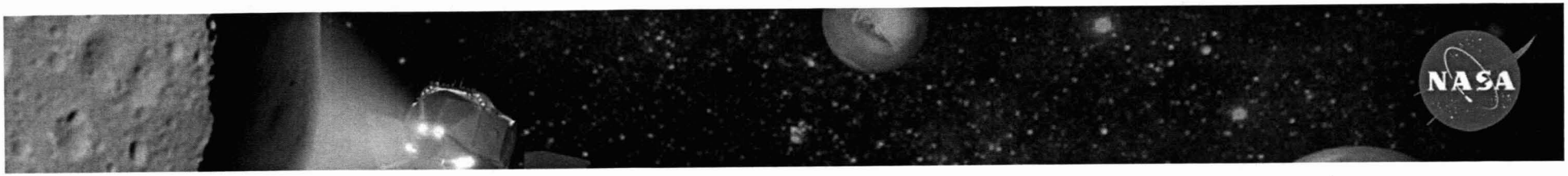
KSC-DESIGNED GEN 1 (ABOVE) AND GEN 2 (BELOW) MODULAR COMM AVIONICS CURRENTLY INSTALLED IN DSH AND SEV

MMSEV





LEFT: HAT GEN 1 PORTABLE COMMUNICATIONS TERMINAL (PCT) PROTOTYPE, RIGHT: FLIGHT CONCEPT PCT



Advanced Weather Technology

UAV Sensors for Static Electric Fields

Description:

Prototype solid state static electric field sensors and integrate with an Unmanned Aerial Vehicle for measurement of atmospheric electric fields. Calibrate, test and fly demonstration missions.

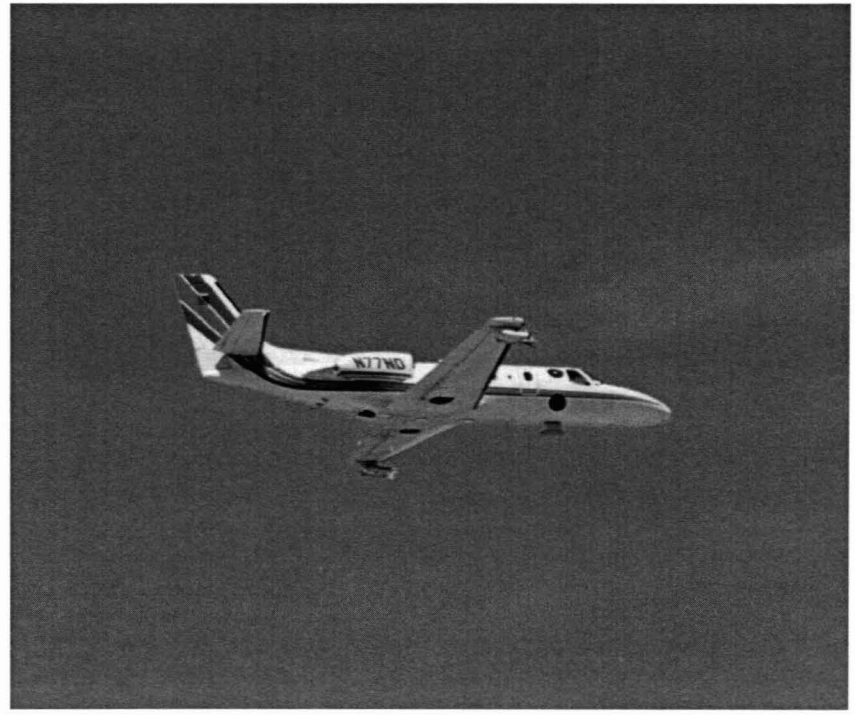
KSC role: Requirements development, test procedures, flight program planning, data analysis.

Relevance to NASA's mission:

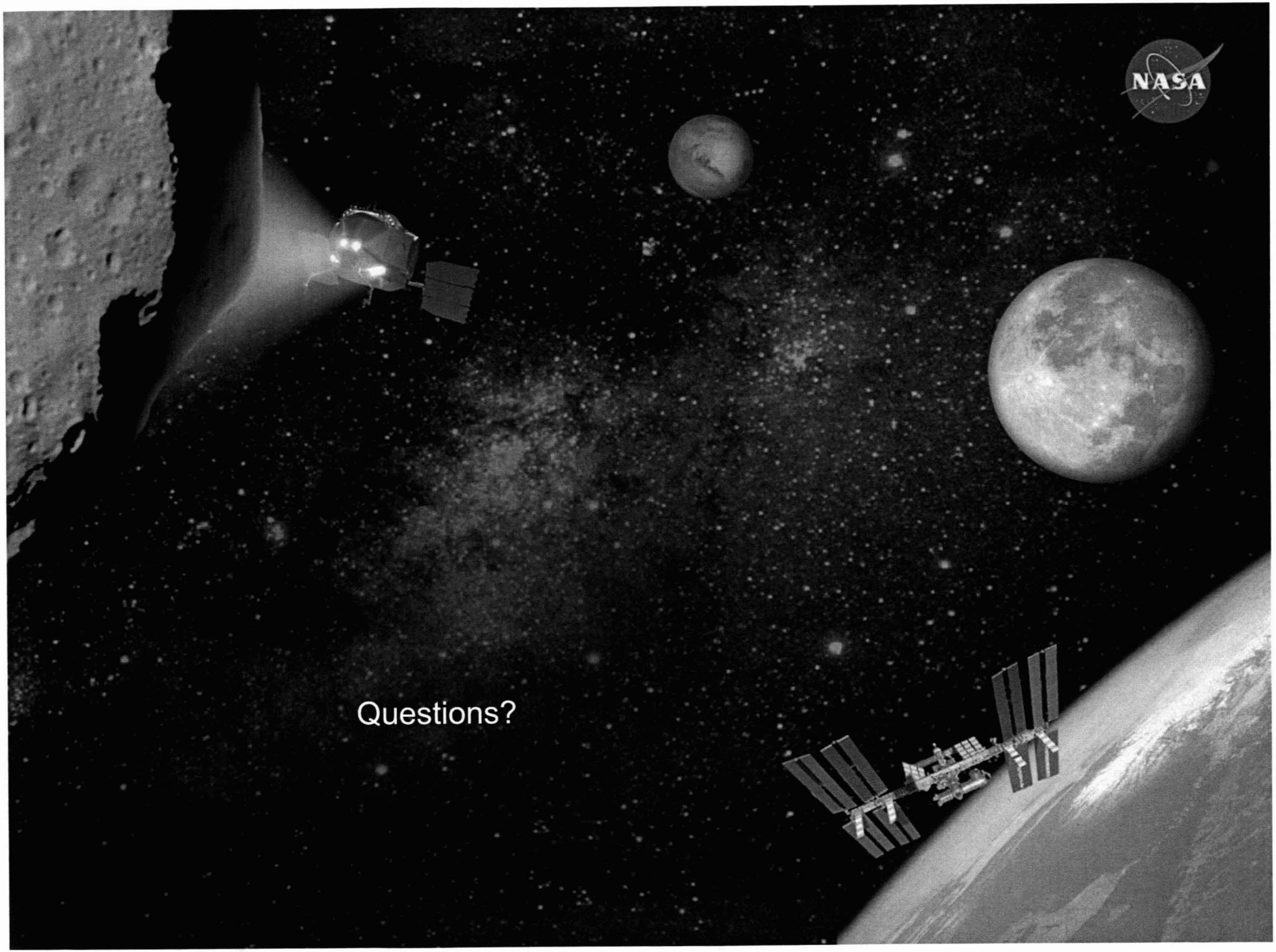
Capability will reduce cost of measurements necessary to improve lightning launch commit criteria (LLCC) by an order of magnitude. Improved LLCC will reduce launch scrubs and risk.

Team

- Lead Center: KSC
- Project Lead: Dr. Francis Merceret
- Existing partners: Physical Optics Corporation, ERAU
- Supporting Centers: MSFC



Crewed airborne field mill aircraft shown above can be replaced by much less costly UAV if current field mills can be replaced by miniaturized solid state units.


NASA
Questions?